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ELEMENTS TO BE CONSIDERED IN FIXING WATER RATES

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The modern cry for what has been happily termed the "square deal" is exercising a material influence on the management and operation of public utilities, particularly in their relation to the public. It is considered essential that all service rendered by a public utility shall be paid for by the recipient of this service, and that the payment for this service shall be proportioned to its cost to the public utility, so that no one consumer, large or small, shall receive special favors and benefit by rates lower than is fair, or suffer from rates higher than is fair. The basic principle of all rate making for public utilities is that a fair rate of profit shall be assured to the public service corporation, and that this profit shall be made up of a correspondingly uniform rate of profit on all portions of the service rendered. Wholesale rates or quantity discounts are to be justified only in so far as they are based upon a lesser cost of service under such conditions.

The public water supply company, which is probably the most important of all such public utilities, one which comes into most intimate contact with individual consumers, and whose proper management and fair dealing comes quickest home to the health and welfare of the individual, must make its rate to its customers on this basic idea.

Confusing Conditions

The cost of service and rates to be charged for water supply has in the past usually been, and still is, seriously confused by the special conditions attending this service. Some of the supplies are operated by the public themselves through their municipal government; others are operated by private companies for their individual profit; still a third class by a combined system in which the management of a private company is to some extent controlled by the public administration. Again, of the public water supplies, some are operated practically at cost, with the idea that the furnishing of

water to the citizens is a civic activity for the welfare of the citizens and that no profit should be charged for this service but only the cost of the service returned to the government. Some city governments supply this water at a loss, charging materially less than the cost and making up the deficit by a general tax levy. Still a third class charge a price for the water materially higher than its cost, bringing in a considerable profit, which is credited to the general income of the administration.

A further complication arises from the fact that water service for fire protection is often furnished either by the city or by the private water company free of any charge to the city government or to individuals. The water for public use for the municipal buildings, school-houses, hospitals, and prisons, is likewise furnished free of charge. In some cases water furnished for institutions maintained for philanthropic or charitable purposes, such as churches, hospitals and cemeteries, is not paid for.

Basic Principle

Such confusing and undesirable complications of bookkeeping make more difficult the determining and charging of equitable rates for the various classes of service. For the proper fair dealing to all, certain basic principles must be established.

1. All water furnished by the water service company should be billed and charged for at a fair rate, proportioned to the service, to pay a fair profit to the water company or to the public water service.

2. Water furnished for general public use or for fire protection or to any class of users to whom the city wishes to make a subsidy should be charged for at the normal rates. If the conditions of the franchise are such that such water must be furnished free by the water company, the service should still for proper bookkeeping be determined and charged even if it must be balanced by a credit which is practically a tax on the water company equal to the amount of this water bill.

On this principle there will be neither greater nor lesser income, either gross or net, to the public water service or water company, but there will be a clear understanding of the proper charge for each class of service, and charges can then be fairly divided.

The old forms of water rates which have in the past been based on no understanding of or care for the cost to the service were usually

flat rates, depending on the frontage of the property, the number and class of fixtures connected in the property, or the size of the tap to the street mains. Such a method of charge alone was highly undesirable and uneconomical. Waste of water was greatly encouraged and charges made to the various properties were almost invariably without any real relation to the cost and value of the service rendered. This method has been superseded in many cases by a straight meter system, in which the charge is made at a uniform rate based on the quantity of water actually registered. This charge is made high enough so that the total income produced will be the necessary amount to pay all fixed and operating charges and to leave a fair allowance of profit. The entire cost is then on the consumer alone and the apparent fairness of such a method has made it undeservedly popular and it has often been compared to the same method of charging for gas delivered.

The fairness of this method of charging is, however, only apparent and not real. The true cost of the service is no more to be properly based only on the amount of water consumed than it is to be based only on the number of fixtures connected in a house. It is not too much to say that there are even cases where the old-fashioned flat rate method of charging is actually fairer than this meter rate. The cost of service includes not only the cost of the water actually consumed on the premises, but it includes a large "readiness to serve" charge, which is always a material item in the cost and depends on many other factors apart from the amount of water used.

Elements of Rates

The elements to be considered in fixing water rates are fundamentally:

1. The total cost of service.
2. The division between the cost of service to the public generally and the cost to the individual consumer.
3. The division in the cost of service to the individual consumer between those elements of cost comprised in the phrase "readiness to serve" and those elements of cost proportioned to the amount of water actually consumed.

Plant Value

The total value of the utility is a very difficult quantity to determine properly, and it can be judged only by considering the question of appraisal from a number of standpoints. One important indicator is the book cost, showing what has actually been expended on the property after making suitable allowance to bring the bookkeeping methods up to what is required by modern practice. This book cost will, of course, make no allowance for changes between the value at the time the works were constructed and the present time, during which period the costs of material may have either increased or decreased and the costs of labor usually increased. It will, however, include practically all other elements of value.

The earning power of the utility under current rates is of itself no indication of the fair value of the plant. It is possible, however, to get some suggestive ideas by considering what would be the earning power of this utility at rates which are current and accepted as satisfactory with other waterworks property of somewhat similar nature and making due allowance for the actual conditions of operating expenses and other charges peculiar to the locality in question.

The most common and most generally accepted method of deriving the value of a waterworks plant is to make an appraisal of the cost of reproduction of its physical plant new, taking as unit prices averages of those current for material and labor over, say, the last five years. An addition to the net reproduction cost of physical plant must be made for engineering, legal expenses, clerical work, administration, and contingencies, ranging from 12 to 18 per cent, depending on local conditions.

In addition to these, an allowance must be made for interest on money invested during the period of construction. This period will vary according to the size and nature of the property, but will rarely be less than two years, and the cost of this interest may be taken at 6 per cent on one-half the reproduction value of the property for each year it is estimated the period of construction will last.

Other items of overhead expense which are often logically and fairly incurred are discount on bonds and the cost of promotion services. There are some cases where such charges are not properly to be included, but in the great majority of private waterworks properties these are fair elements of value and represent money ac-

tually expended. The amount of these items cannot be averaged, and must be judged from the nature of the property and its peculiar conditions.

A further item to be included in the value of the property is a fair allowance for working capital. This for an average property may be taken as a sum amounting to six months' operating expenses.

A further element of cost is what is usually called "water rights." If the owners of the waterworks property have an exclusive private ownership of the right to take the water needed for the purpose from certain places, this right represents a value which must be allowed for. In some cases the value of this water right can be measured by the difference of cost occasioned by attempting to get water from some substitute source. For those cases where no substitute source is possible, there is no concrete basis for evaluating the water rights, and an allowance must be made which seems fair in the judgment of the appraiser.

The last of the elements going to make up value is an item sometimes called "development expense" or "going value." This going value represents the difference between the actual live working utility and a plant which would have all its other assets and properties, except that of being in operation, having customers, and actually supplying them with water. Many arithmetical systems of calculating this going value have been suggested, but in the last analysis it comes to a question of judgment and the amount which, in the best judgment of experienced men, is to be allowed for this item will vary according to the nature of the property, ordinarily ranging from 10 to 20 per cent of the sum of all other elements of value.

Having obtained in this way a sum representing the total value of the utility under present conditions, all returns in the nature of interest and profit will be based in the majority of cases on the value of this property in its new condition. In some cases the depreciated value obtained by deducting the physical depreciation from the value new is a proper basis for returns. In still other cases an intermediate value is a fair one. There is no simple, universal rule for determining this proper basis, as it will largely depend on the adequacy or inadequacy of the income of the property properly to provide a suitable depreciation fund to maintain the property and to return its value to the investor at the end of the period of his franchise, if this is a limited one.

Cost of Service

The total cost of service is made up of a number of elements. The first of these is operation, and the second maintenance. These are entirely dependent on local conditions and cannot in any way be averaged or prejudged. The third element is the depreciation charge sufficient to maintain the property in first-class operating condition at all periods of its life, to renew any wornout or obsolete parts, and generally to provide a sufficient fund so that the investment may be maintained intact. This depreciation fund varies according to conditions, but may be assumed in the absence of special information to range from 1 to 2 per cent per year. The fourth element is interest on the investment, which may be taken as 6 per cent of the total value of the utility. The fifth and last element is profit, and this may be taken in addition to the interest allowance to be an average from 1 to 2 per cent of the total investment.

The sum of these elements fix what must be the gross income of the water supply utility. In considering the division between public service and private service, it will often be found that public service is not directly charged for. If the water supply is provided by the city government itself, the water department should bill against the general tax fund a fair charge for this public water service, and this public water service should be paid for not by the water consumers alone, who do not get the only benefit for this service, but by the city at large, for it is the city at large that benefits. If, on the other hand, a private water company is forced by the terms of its contract to give such water service without charge, or if partly paid for to give this service for an inadequate payment, the total cost for the excess of cost above payment of this class of service should be properly determined, and if it is necessary to charge it against the water consumers, as unfortunately it sometimes is, it should be charged not against the actual gallons of water consumed, but as an overhead charge in the form of "readiness to serve" charge.

With this preliminary consideration of cases where rates cannot be properly billed as they should be, the determination of fair water rates can be made.

Fire Protection

The investments for fire protection purposes include a number of elements which are obvious and a number which, though not so easily seen, are just as real. For the purpose of supplying the needed water for fire protection there will be required additional expense on all parts of the construction of the system, starting with intakes, conduits, and continuing through pumping station reservoirs, purification plants, distribution system, hydrants, and connections. For operating service there will not be required a large volume of water for fire purposes, but the fixed part of the operating expense not depending upon the amount of the water supplied must be in part charged to this fire service. In addition, a fair proportion of losses from the mains in the form of leakage which may amount to 25 per cent of the total water distributed is fairly chargeable to this part of the service. The ultimate proportion of the total investment and maintenance occasioned by or needed for fire protection will depend on the nature of the water supply system and the size of the plant. A water supply system delivering water by gravity from a large reservoir will have only a portion of the reservoir and distributing mains chargeable to fire protection. A direct pressure pumping system, however, will have a portion of all parts of the system needed for fire protection alone, and this element of the service will sometimes occasion a greater expense than the actual water consumed. A large system obviously need be extended only moderately to provide additional water and distribution facilities for fire service, while a small system must be heavily reinforced for this purpose.

The part of the water system properly chargeable to fire protection may range in a general way from 5 per cent in a town of 300,000 inhabitants up to 75 per cent in a town of 5,000 inhabitants, according to the local conditions.

An additional element is introduced under conditions where private consumers are encouraged or permitted to have connections for fire protection service, and the question arises whether such private fire protection should be charged to this individual consumer or whether it should be borne by the public. A decision on this disputed question will never be agreed to by all, but must remain a matter of opinion. It is our opinion that it is to the best interests of the public at large to encourage the use of such connections for

fire protection, and that the cost of these connections should be borne by the public, together with the costs of all other items of fire protection service.

The commonest way of charging for this public fire protection is in the form of a rental for hydrants installed. This method is not in every case an absolutely equitable one, as the cost of the water property is not entirely to be measured in proportion to the number of hydrants connected. If, however, the number of hydrant connections is a reasonable one and the rate of hydrant rental service is properly proportioned to the costs of the particular service and its conditions, this method of charging should be perfectly satisfactory.

The hydrant rentals common in this country range from nothing or nominal amounts to about \$60 per hydrant per year, with an average over the country of about \$40 per hydrant per year. On the basis of population the cost of this fire protection service will probably range from \$0.15 to \$1 per capita per year.

Public Consumption

Water supplied for public use is that delivered to the city for use in public fountains, for use for street sprinkling and street flushing, for municipal buildings, school buildings, and in addition water donated by the city to charitable institutions of various classes. The total amount of this may average 10 per cent of the total amount of water delivered. As we have above stated, all water used in this way should be considered and charged to the public exactly as water delivered to any other consumer, and will not affect fair average rates.

Private Consumption

The cost of water service to the water consumer is the next division which is to be considered. This should be fairly separated from other items of water service noted above, and only this portion of the water utilities cost should be charged to the consumer as a consumer. All other elements of expense are for the general public welfare and should be borne by the general public and not assessed against the water consumer alone. The consumers' rates should properly be such as will return to the public utility a profit on the cost of this particular service.

Having separated that portion of the total cost which is to be collected from the water consumer, there are two classes of charges which are to be made. The first of these is a service charge made against any consumer connected with the water system and embraces those elements of cost which are occasioned by the water utility being ready to deliver to the consumer his maximum required amount of water. The second of these is the water charge, and covers only the cost of the water consumed.

Service Charge

The general popular opinion which, aiming at justice, overshoots the mark, is that equity is observed in charging all consumers in proportion to the amount of water for use. The heavy costs of the "readiness to serve" charge are not fully appreciated. It costs the water company almost as much to connect a meter to a vacant house and stand ready to supply water at all times as it does to deliver the ordinary water consumption to a house using the average amount of water. The only difference between the two is this second element or charge for water alone.

The service charge which must be based on the maximum amount of water demanded by the consumer includes interest, depreciation, and profit on the investment of so much of the water company's property as is needed to deliver this maximum amount of water. This part of the property is usually the great bulk of the total. In the extreme case of a gravity water supply of an impounded water delivered to the consumer without purification and without pumping, it will cost the water company no more to deliver continuously over the twenty-four hours a quantity of say 4 gallons a minute to the consumer than it will cost to deliver to him the same amount only for one-half hour a day, particularly as the small consumer is almost sure to use his small quota of water at the peak of the load on the distribution system, and the distribution system must be proportioned to his maximum demands, though they are of short duration. For such conditions a meter system has only a limited function and a limited value, and has any value at all only because the times of water consumption, though roughly the same, will not exactly coincide, and the overlapping or maximum consumption of individual consumers will mean a slightly lesser total than the aggregate of

maximum demands. Another element of the "readiness to serve" charge is the overhead expense of administration, the expense of maintenance of the distribution system, the expense of supplying and maintaining meters, reading meters, making bills, etc.

Another element of the "readiness to serve" charge is leakage of street distribution mains. This leakage will seldom be less than 20 per cent and may easily exceed 40 per cent of the total amount of water handled. There is no reason why this leakage should be charged to the water consumer alone. It should rather be charged to all connected consumers, including the public service and public fire protection and all private consumers in the form of a service charge.

The last element of the service charge will be what is sometimes called "under-registry of meters." This is really occasioned by the condition that a continuous small leakage from the plumbing fittings in the house causes a loss of several gallons per hour, which is at too small a rate to register on the meter. This loss may range from 5 to 20 per cent of the total. It is, of course, in no sense proportionate to the actual registered consumption of the connected consumer, but is rather roughly proportionate to the service charge which is more nearly in the ratio with the number of fittings the consumer has connected.

The aggregate of all these costs should be charged against the individual consumer in the form of a service charge which should be proportionate either to the size of his meter or tap connection to the main or else the number of fixtures connected. The latter basis is probably a trifle more equitable than the former, but for the sake of simplicity it is probably desirable to base this service charge only on the size of the meter. The amount of this service charge, while varying with the nature of the water service, in all likelihood should never be less than \$5 per year for a $\frac{1}{2}$ -inch meter, which is the smallest in ordinary use, and in some cases it may fairly run to more than double this amount.

Water Charge

The final element of water service charges is the amount to be charged for the water actually consumed, as registered by meters. This will also vary according to the conditions of the water supply,

and may run from a very small figure to a very high one. It will comprise the costs actually expended for water delivered, including such elements as labor, pumping operation, returns on capital invested for water delivered, and other similar charges. The fair charge for such water delivered and actually registered will probably run from 4 cents to 20 cents per thousand gallons, in addition to the "readiness to serve" charge, which, as above stated, will run from \$5 to say \$15 per year for the $\frac{3}{4}$ -inch meter connection.

In brief, then, the income of the water utility, whether publicly or privately managed, should make an operating fund to cover the cost of operation, the maintenance of the property to take care of current repairs, a depreciation fund to cover the fund maintenance and repairs, obsolescence, and in general maintain the property at its maximum efficiency, interest on the value of the property both tangible and intangible, and finally, an allowance for profit. This income is to be derived:

1. From the public purse for services rendered to the public at large.
2. From a service charge made against all connected consumers, whether public or private.
3. From a meter charge for water actually consumed.

In the past the making of water rates has suffered from the fact that the bias of the rate makers towards certain ends has been substituted for a straightforward analysis of the elements of expense. On the one hand, the flat-rate system has been used only for the purpose of getting the desired income in the simplest way. On the other hand, the straight meter rate faddist has aimed at a straight fixed rate only for such water as is metered, so as to reduce waste.

The only fair method is to charge for any service what it is worth, which means here a combination of service charge and a moderate water rate charge. By such means it is possible that meters may find a ready acceptance in some places in which they have so far been unable to make entrance.